**Small Business Innovation Research/Small Business Tech Transfer**

# Low Temperature In Space Additive Manufacturing of Metals and Alloys for NASA Missions, Phase I

Completed Technology Project (2018 - 2019)

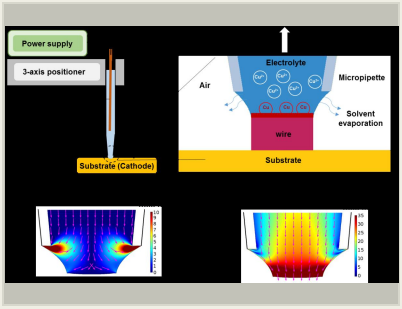
## Project Introduction

The overall goal of this project is to demonstrate the feasibility of 3D printing of ferrous, Cobalt, and
Nickel-based alloys, using UHV's innovative low temperature 3D printing technology for metals and alloys. This technology is based on electrochemical (co-)deposition of metallic ions at the tips of an array of electrolyte-containing nozzles, which are controlled by CAD files from a computer program. This technology has been successfully applied to 3D printing of Copper for printing very large
area (several meters in size) printed circuit boards and flexible plastics. In the proposed project, the feasibility of applying this technology to alloys will be investigated, in particular iron-based, nickel-based and cobalt-based alloys.

## Anticipated Benefits

Several NASA programs are embracing metallic Additive Manufacturing (AM) technologies for their potential to increase the affordability of aerospace components by offering significant schedule and cost savings over traditional manufacturing methods. The proposed low temperature alloy printing technology overcomes many of the problems associated with laser and e-beam based 3D metal printing such as high temperature and thermal stress induced defects.

The proposed room temperature metal 3D printing enables, for the first time, fabrication of metals, alloys and plastics in the same 3D printer enabling fabrication of PCBs, printed electronics, microfluidics, thermal management heat pipes and complex devices containing plastic, metal and ceramic components. Thus this technology will find wide spread application across all types of industries.

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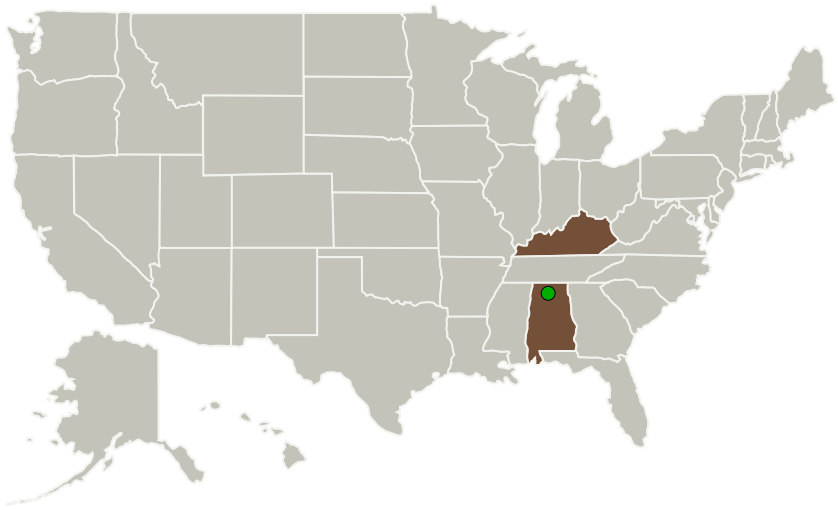
## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| UHV Technologies, Inc. | Lead Organization | Industry<br>Minority-Owned Business, Small Disadvantaged Business (SDB) | Lexington, Kentucky |
| Marshall Space Flight Center(MSFC) | Supporting Organization | NASA Center | Huntsville, Alabama |

| Primary U.S. Work Locations | |
|---|---|
| Alabama | Kentucky |

## Project Transitions

**July 2018:** Project Start

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

UHV Technologies, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

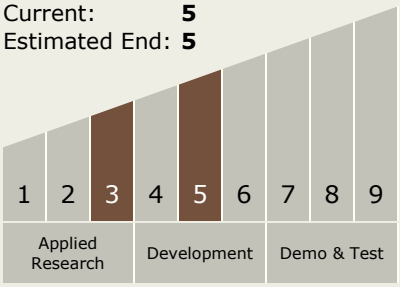
Carlos Torrez

**Principal Investigator:**

Nalin Kumar

## Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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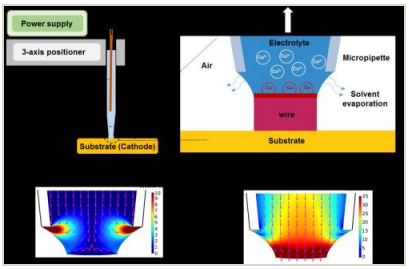
**February 2019:** Closed out

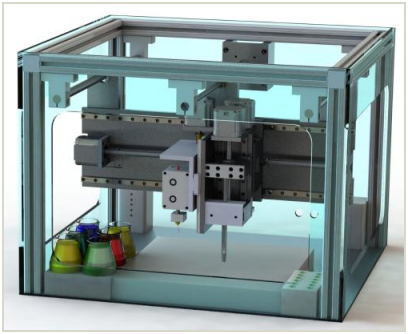
**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/137856)*

## Images




**Briefing Chart Image**
Low Temperature In Space Additive Manufacturing of Metals and Alloys for NASA Missions, Phase I *(https://techport.nasa.gov/image/137259)*



**Final Summary Chart Image**
Low Temperature In Space Additive Manufacturing of Metals and Alloys for NASA Missions, Phase I *(https://techport.nasa.gov/image/130634)*

## Technology Areas

**Primary:**

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

## Target Destination

Foundational Knowledge